really know why the above rule gives the desired result and not, for example, the equation of a line through the given point and perpendicular to the given line? Very few, it will be found, really know. The reason for this is that the fundamental principle involved, namely that parallel lines have the same slope but different intercepts on the $y$ axis, has been mentioned implicitly and not explicitly. If such rules as the above (and there are many more of the same type) were written so that the fundamental principle involved were explicitly stated, the student would benefit greatly thereby.

Experience makes it certain that a student learns more mathematics, can pass a better examination (if that is a criterion for excellency in the subject) if he knows the fundamental formulæ, the fundamental principles, and has been taught to reason and not memorize.

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## BOOK REVIEWS.

EDITED BY W. H. BUSSEY.

*Advanced Algebra.* By JOSEPH V. COLLINS. American Book Company, New York. x + 342 pages. $1.00.

The subject matter for a freshman course in algebra as presented in the great majority of text books does not vary much. This book differs slightly from the usual algebra in this respect. It is divided into three parts. Part I, containing five chapters, is devoted to a review of the elementary algebra through simultaneous quadratics. At the end of chapter four is a list of the fundamental principles. This is followed by a short explanation of the most common errors arising from not following these principles. The fifth chapter contains a list of the theorems of plane geometry used in the rest of the book.

Part II is made up of the chapters on graphs, ratio and proportion, logarithms, the progressions, annuities, the binomial theorem, and inequalities. The author makes evident the connection between algebra and trigonometry by following proportion with the definitions of sine, cosine, tangent and cotangent, and applying these to problems involving right triangles.

In Part III are found the topics which belong to advanced algebra proper; namely, theory of equations, permutations and combinations, probability, determinants, series, undetermined coefficients, continued fractions, and complex numbers. Some of these topics are discussed very briefly. The student is supposed to get many of the principal facts of the subject from simple, concise proofs, yet he is not burdened with too much theory of the kind which does not appeal to the average freshman. In dealing with the complex number, the addition theorem of trigonometry is derived for use in establishing De Moivre's theorem. A further connection between algebra and trigonometry is thus made.

At various places short historical notes are added. These consist, for the most part, of biographical sketches of great mathematicians, and are so placed

that they follow the subject with which the man's name is intimately associated. The chapter on logarithms ends with short notes on Briggs and Napier, that on the theory of equations with one on Gauss, determinants with one on Sylvester. A few pictures of mathematicians are also introduced.

GEO. W. HARTWELL.

*Theory of Functions of a Complex Variable.* BY DR. H. BURKHARDT, Professor in the Technical School, Munich. Authorized English translation, with the addition of figures and exercises, by S. E. RASOR, Professor of Mathematics, Ohio State University. D. C. Heath & Co., Boston, 1913. 421 pages. $4.00.

This book is a close translation of the second part of the first volume of Professor Burkhardt's *Funktionen-Theorie.* Since the latter is no doubt well known to those interested in this field, it will perhaps be sufficient here to give the chapter headings and to indicate briefly the additions made by the translator. Chapters, sections, and theorems are numbered exactly as in the German text.

Chapter I. *Complex numbers and their geometrical representation.* The translator has added at the end of the chapter 32 exercises designed to give practice in the use of the complex number.

Chapter II. *Rational functions and conformal representations determined by them.* Nine lists of exercises, containing 78 individual problems, have been added. Also, following § 21 there has been added § 21$a$, 7 pages, devoted to the function $w = \frac{1}{2}(z + z^{-1})$; and following § 22 there has been added § 22$a$, 6 pages, treating the function $w = z^3 - 3z$.

Chapter III. *Theory of real variables and their functions.* Four lists containing 31 exercises have been added.

Chapter IV. *Single-valued analytic functions.* A brief section, § 30$a$, on limits of convergent sequences of complex numbers, and ten lists containing 119 exercises have been added by the translator.

Chapter V. *Many-valued analytic functions.* The translator has added § 57$a$ on the function $\tan^{-1} z$, § 60$a$ on rational functions of $z$ and $\sqrt{z}$, § 62$a$ on rational functions of $z$ and $\sqrt{(z-a)(z-b)}$, § 62$b$ on integrals of rational functions of $z$, etc., § 62$c$ on the function $z = w + i\sqrt{1-w^2}$, § 62$d$ on the function $\sin^{-1} w$, 27 pages in all, and six lists containing 67 exercises.

Chapter VI. *General theory of functions.* Three lists containing 48 exercises have been added.

This is without doubt a most timely book, for the need of a text in English of about this scope has long been felt. It is to be regretted that some discussion of the logarithmic potential and of streamings in general was not added for the benefit of students of physics who study the theory of functions for its applications. However, with nearly four hundred exercises added to round out in many important particulars the excellent work of Burkhardt, we now have available in English a most satisfactory text-book on the theory of functions of a complex variable.

W. C. BRENKE.